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(54) Improvements in or Relating to Thermal Insulation Systems, e.g. for Furnaces

(57) It is known to construct an insulation block from a blanket or blankets of high temperature insulating fibres by superimposing layers of blankets so that they extend generally normally to the principal faces of the block. Such a block may be constructed from strips of blanket or by folding a blanket in concertina form. The invention aims to provide a satisfactory and economic method of securing such blocks to a furnace wall 23. This is achieved by incorporating into such a block in a predetermined position an apertured elongate member (1) which can be engaged by and connected to a suitable stud (7) which is inserted into the block during the fixing operation.

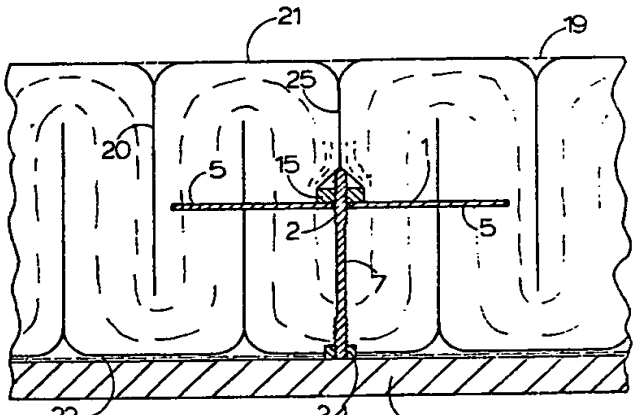

FIG. 6.

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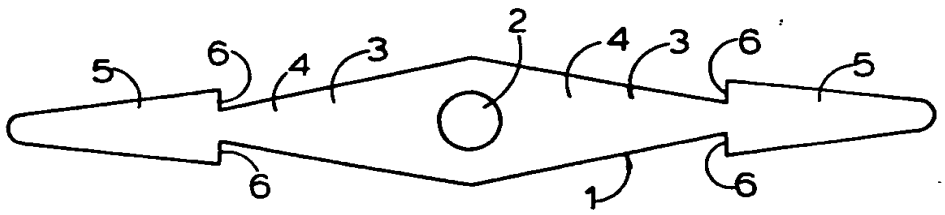

FIG.1.

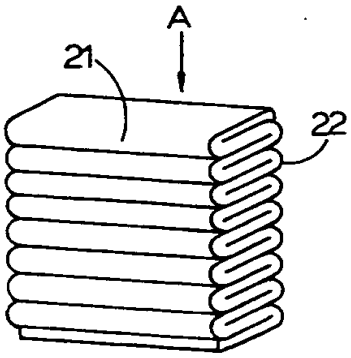

FIG.4.

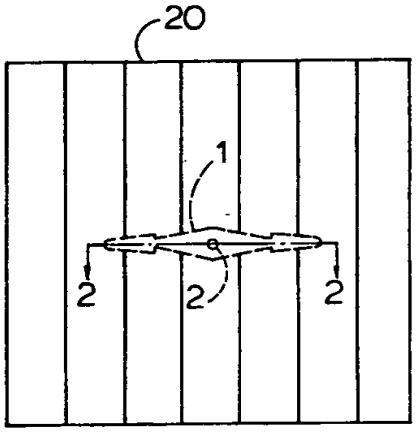

FIG.5.

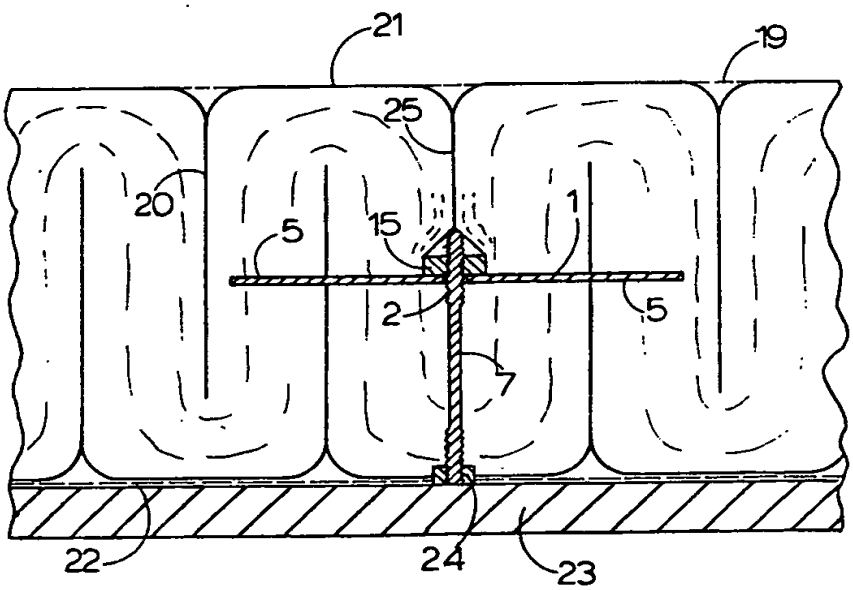

FIG. 6.

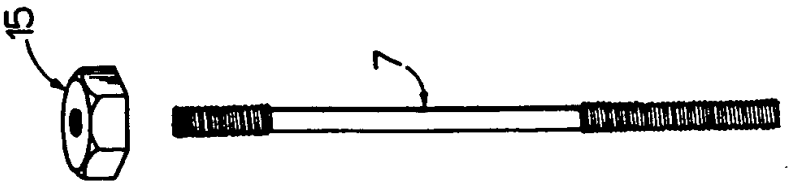

FIG.3

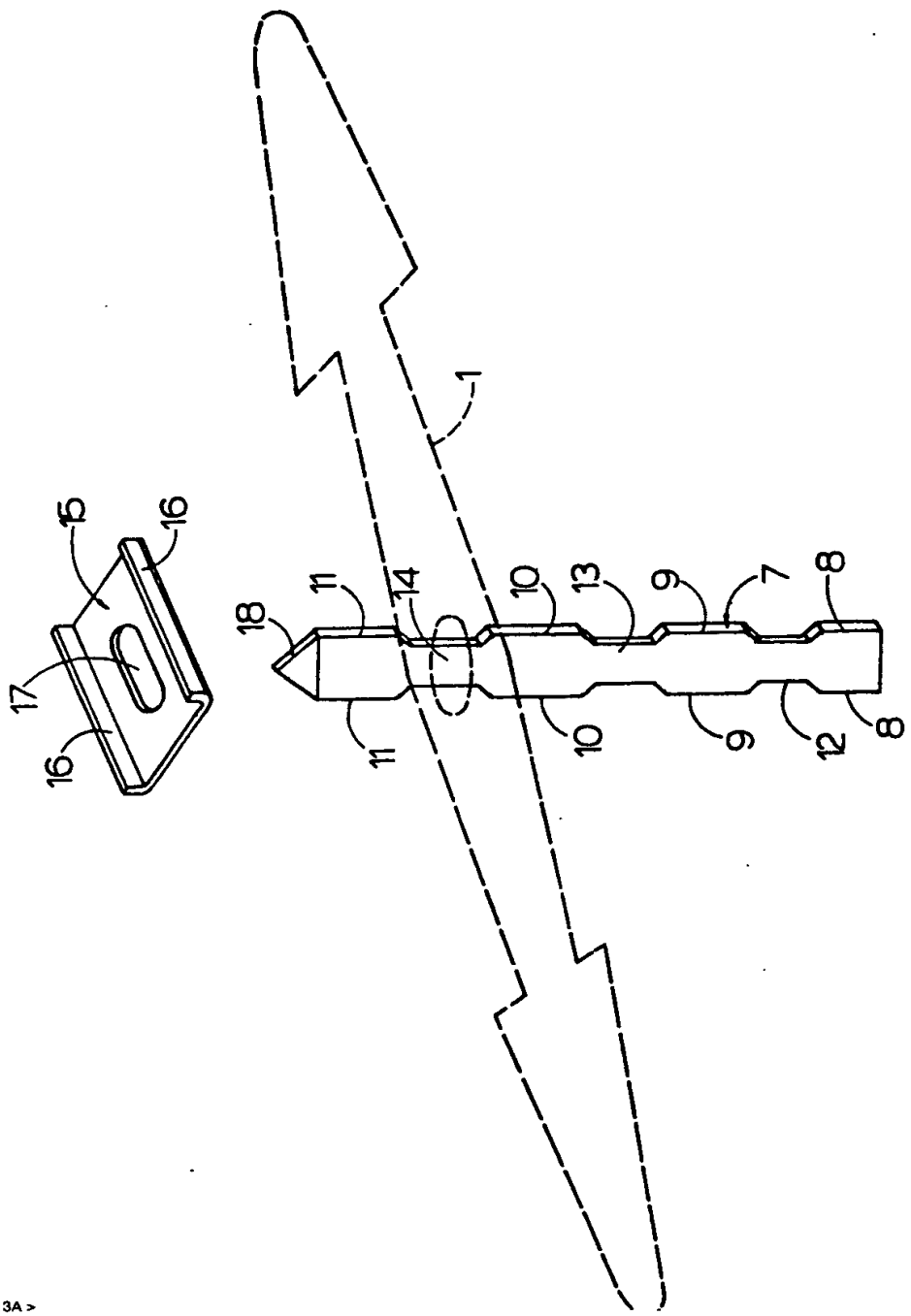

FIG.2.

SPECIFICATION

Improvements in or Relating to Thermal Insulation Systems

This invention concerns improvements in or relating to thermal insulation systems, in particular systems which are used in high temperature conditions such as for furnace or oven linings.

It is already known to provide a thermal insulation mat comprising a blanket of ceramic fibres or mineral wool fibres or a combination of such fibres that is secured by stud fixings to support such a furnace casing. However, such blankets cannot easily be made very thick and in order to achieve the necessary thermal insulation, blankets have been superimposed in layers parallel to the furnace wall to build up the required mat thickness. Sometimes different quality and/or composition blankets are used for the layers so that the more expensive and most heat resistant material such as ceramic fibre blanket is the outermost layer. Now in practice, this layering is time consuming and the stud fixing system must hold the layers in place during the fitting of the materials.

It has also been proposed to build up a mat of such blankets with blanket layers extending in planes substantially normal to the furnace wall, at least for a substantial thickness of the mat.

Such that a mat may conveniently be assembled from a series of modules or blocks of a size and shape that is convenient to handle. Each block comprises a support engaging face, and for at least a substantial thickness of the block normal to said face the block comprises superimposed layers of blanket extending in planes substantially normal to said face, the blanket layers being formed of high-temperature insulating fibres. Such a block will hereinafter be referred to as a block of the kind set forth.

We have proposed to form a block of the kind set forth by folding or pleating a blanket, or two superimposed blankets having different properties, accordion-fashion so that the support engaging face and the opposite face of the block each comprise a series of closely adjacent fold faces, with the thickness of the block being determined by the length of each layer of blanket.

A block of the kind set forth may incorporate a bonding agent which rigidifies the blanket layers. Alternatively the blanket layers may be held in slight compression by binding or strapping secured around the block. Such strapping may be destroyed during initial heating of the block in use.

Blocks of the kind set forth still have to be mounted and secured to the support, and in some cases the blocks will be superimposed on other blocks or layers of blanket. Normal mounted methods are not suitable for such blocks, and we have therefore devised a special system for installing these blocks.

According to the invention we provide a thermal insulation system comprising at least one block of the kind set forth for mounting on a support, the block having an elongate rigid member extending through the superimposed layers of blanket substantially normally to the planes of the layers and intermediate the support engaging face and the opposite face of the block, the member having an aperture through which a metal stud is adapted to be pushed so that it extends substantially normal to said support engaging face, one end of the stud being adapted for fixing to the support and the other end to receive a locking retainer engageable with the elongate member.

Although the locking retainer could be secured to or integral with the elongate member the locking retainer preferably comprises an independent member.

The elongate member preferably is a metal plate which extends through one or more of the superimposed layers so that it is adequately held in the block and can distribute the loads applied to the block during mounting and fixing. The metal plate may be formed like a spear with barbed ends to locate it in the block against movement.

The stud may be a rod having a threaded end for threaded engagement with a boss or sleeve or nut fixed to the support. Alternatively, the stud may be arranged for welding to the support, for example by projection welding.

The other end of the stud may also be threaded to receive a nut for threaded engagement so that the nut, preferably with an intervening washer, can be threaded along the stud until it engages the elongate member. Conveniently, this can be done by opening up the block between adjacent layers, or by arranging the aperture for the stud to be aligned in a fixed position that a fitter can find by piercing the block with the stud.

Alternatively, the stud may have a formation thereon to enable a twist-lock type of retaining washer or collar to be used. Such a stud may have a pair of opposed flats, or ears which are engaged by a washer with an elongate or oblong central aperture that can be slid over the stud and then turned to locate on the flats or ears.

The elongate member can be introduced in the blanket during the folding operation or insertion prior to the fixing of the folds by the bonding agent or the straps.

As will be appreciated, the block could have more than one elongate member so that the stud position can be varied, or more than one stud could be used for each block. Furthermore, the elongate member may have more than one aperture.

The block is preferably provided with means for indicating the location of the aperture or apertures in the buried elongate member.

The invention will now be further described, by way of example only, with reference to the accompanying drawings in which:—

Figure 1 is a plan view of an elongate member in the form of a barbed metal plate;

Figure 2 is a perspective view of a stud and

retaining member for use with the elongate member of Figure 1, that member being indicated in dotted outline;

Figure 3 is a perspective view of an alternative stud and retaining member for use with the elongate member of Figure 1;

Figure 4 is a view of a block which has been produced by folding a blanket in concertina fashion;

Figure 5 is a side elevation of a block similar to that of Figure 4 but incorporating a buried elongate member similar to that of Figure 1; and

Figure 6 is a cross-section on the line 2—2 of Figure 6 on a larger scale and showing the block secured to a furnace wall by the stud of Figure 3.

With reference to Figure 1, the elongate member 1 comprises a stamping of mild steel of length 125 mm and thickness 1 mm, provided with a central hole 2 to receive a stud and with oppositely directed arms 3. Each arm 3 has tapering inner and outer portions 4 and 5 connected by steps 6 which act as barbs to resist the arms 3 of the member 1 being pulled outwardly of a blanket once it has been inserted into the blanket. The dimensions of the elongate member will, of course, depend upon the weight of block being secured. A thicker elongate member would usually be required for securing the same blocks to a furnace roof.

The stud 7 of Figure 2 is flat in transverse cross-section and comprises a mild steel stamping. The stamping is formed with four pairs of axially spaced ears 8 to 11 between which are defined waisted portions 12, 13 and 14. A pressed sheet metal locking retainer 15 comprises a rectangular plate provided with upstanding peripheral flanges 16 on opposed sides and with a central elongate aperture 17. The dimensions of the apertures 16 are chosen such that the retainer 15 can be passed over two ears 8 to 11 in the relative orientations shown in Figure 2, but when the retainer 15 is twisted through 90° about the axis of the stud 6 it is unable to clear the ears and may therefore be retained located around any of the waisted portions 12, 13 or 14 to hold the elongate member 1 against upward movement relative to the stud 6 when the retainer overlies the member 1. The diameter of the hole 2 in the member 1 is, of course, chosen such that the stud can pass freely through hole 2. The upper end 18 of the stud is pointed to assist the insertion of the stud into a block. The ears 8 at the lower end may be secured to a furnace wall by welding.

In the construction of Figure 3 the stud 7 in this case comprises a steel rod threaded at both ends, and the retainer 15 is a steel nut which may be backed by a washer.

The blocks shown in Figures 5 to 6 have been produced by folding in concertina fashion a single blanket of refractory fibres designed to withstand temperatures above 2000°F. Such blankets are for instance those manufactured under the trade names Fibre-Frax and Kaowool, and in which most of the fibres lie in planes parallel to the blanket surfaces. A block formed from such a blanket is capable of substantial resilient deformation in the direction of the arrow A shown in Figure 4. In order to hold the block compressed in that direction during the building of a furnace lining from such blocks the block is provided with a cotton scrim 19 shown in Figure 6.

As shown in Figures 5 to 6 the elongate member 1 has been incorporated into the block with its arms 5 extending transversely with respect to the fold lines 20 and approximately midway between the upper and lower surfaces 21 and 22 respectively of the block, the hole 2 being located centrally of the block as viewed in Figure 5.

The elongate member 1 may be incorporated into the block in any convenient manner. One method comprises folding in concertina fashion half of the length of the blanket, to form a half-block, inserting one arm 3 of the member 1 into the half-block, locating the member 1 relative to the half-block by a metal rod passed through the hole 2, folding the remainder of the blanket and gathering the folds onto the opposite arm 3, and finally withdrawing the rod. An advantage of this method is that the rod leaves a small hole in the block to provide an indication of the position of the hole 2.

In Figure 6 a metal furnace wall 23 has been provided with an array of nuts 24 welded thereto, and studs 7 of the kind shown in Figure 3 have been threadedly secured at their lower ends to the nuts 24 before the block has been located in position on the studs with the other end of each stud passing through hole 2 in elongate member 1. After a block has been located over a stud the layers of blanket are parted at 25 to enable nut 15 to be screwed onto the upper end of the stud to bear on member 1 and clamp the central part of the block against the furnace wall 23.

Alternatively the stud 7 and nut 15 could be located in position in the block before the block is positioned against the furnace wall, and the lower end of the stud 7 could be secured to the wall 23 by stud welding, a suitable welding head being inserted between the folds at 25 to engage with the upper end of the stud 7.

Owing to the resilience of the blanket layers the blanket will close over the upper end of the stud at 25 on withdrawal of any tools so that the nut 15 and stud are not subjected to the temperature of the furnace interior. This will enable the use of mild steel studs and retainers in many cases, but, of course any suitable materials may be used for particular applications.

In the arrangement shown in Figure 6 the elongate member 1 extends through two complete layers of the blanket and through a substantial thickness of two other layers. It is unnecessary for the elongate member to extend through all of the layers of blanket since the layers adjacent to the edges of the block are held in place against the wall of the furnace by the adjacent block owing to the resiliently compressed state of the blocks.

In Figure 6 the elongate member is shown positioned midway between the surfaces 21 and 22 of the block, but it may be located nearer to the surface 22 if desired to reduce the temperature to which it is subjected in use. Preferably the elongate member 1 is positioned such that it is spaced from the lower surface 22 by a single thickness of the blanket, that is in intimate contact with the bottom folds.

Depending upon the position of the elongate member, the thickness of the block, and the intended operating temperature the elongate member, stud and retainer may be formed of a refractory stainless steel, such as A.I.S.I. 310 or Inconel 601, the elongate member being of typical size 175 mm long and 3 mm thick.

Claims

1. A thermal insulation system comprising at least one block of the kind set forth for mounting on a support, the block having an elongate member extending through the superimposed layers of blanket substantially normal to the planes of the layers and intermediate the support engaging face and the opposite face of the block, and the member having an aperture through which a metal stud is adapted to be pushed so that it extends substantially normally to said support engaging face, one end of the stud being adapted for fixing to the support and the other end to receive a locking retainer engageable with the elongate member.

2. A thermal insulation system as claimed in Claim 1 in which the elongate member comprises a metal plate lying in a plane substantially parallel to the support engaging face of the block.

3. A thermal insulation system as claimed in Claim 1 or Claim 2 in which the elongate member is provided with at least two longitudinally spaced apart and oppositely directed barbs.

4. A thermal insulation system as claimed in any of the preceding claims in which the stud comprises a threaded rod, and the locking retainer comprises a nut threadedly engageable with the rod.

5. A thermal insulation system as claimed in any of the preceding claims in which the arrangement is such that the stud in use lies in the plane separating adjacent superimposed blanket layers.

6. A thermal insulation system as claimed in any of the preceding claims in which the block comprises a blanket folded in concertina fashion.

7. A thermal insulation system as claimed in any of the preceding claims in which the block is provided with means to indicate the location of the aperture in the elongate member.

8. A thermal insulation system as claimed in any of the preceding claims in which the stud and aperture are dimensioned to enable the stud to be passed entirely through the aperture.

9. A thermal insulation system as claimed in Claim 1 in which the elongate member is substantially as described with reference to Figure 1 of the accompanying drawings, and the stud and locking retainer are substantially as described with reference to Figure 2 of the accompanying drawings.

10. A thermal insulation system as claimed in Claim 1 and substantially as described with reference to Figures 1, 3, 5 and 6 of the accompanying drawings.

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